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USER GUIDE

User guide to run a shrimp simulation

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# 1. Introduction

## 1.1 Purpose

This program was designed and written to simulate the life cycle of a colony of Brine Shrimp. The simulation is used to see how different parameters, such as initial number of shrimp, affect the length of time that the colony survives before the end of the simulation.

## 1.2 Features

The program simulates shrimp with random attributes. The main attributes of the shrimp are:

Life Cycle:

Each shrimp receives a randomised time it has for each of its life stages which are egg, larvae (hatchling), sub-adults (juveniles), adults and the death of the shrimp. These times were tested against Brine shrimps expected life time (Dann & Tomkins, 2009) to reflect a lifetime of a maximum of about 36 weeks.

Images:

As part of the life cycle of the shrimp, they change what they look like as they age, an egg doesn’t look the same as an adult shrimp. As a result, the simulation takes a different image for each stage that the shrimp is through its life cycle. Also, the female adult is given a different image to the male adult to distinguish them from one another for understandability of the simulation. Examples provided for an egg, versus the dead shrimp.![A close up of a logo

Description automatically generated]()

*(left) Image used to display the egg life stage*

*(right) Image used to represent a dead shrimp*

Collisions:

Obviously, in reality only one shrimp can occupy one space in time. So in the simulation, there is included a collision function which constructs a way for the simulation to make sure two shrimp are never allowed to occupy the same space, and so you have the shrimp moving away from each other when they are going to collide.

Reproduction:

When the shrimp are created they are given a random sex. Then each time two shrimp collide they reproduce if they are both adults, of opposite sex and have had sufficient time since they last reproduced. The cooldown time is for practicality purposes of only spawning one egg for each collision, as well as in reality the female shrimp having a 6 day sexual cycle (Dann & Tomkins, 2009), so they can only reproduce once every 6 days.

# 2. Guide

## 2.1 Required files and modules

Make sure to read the README file before use. Before running the simulation the user must ensure that they have these files in the program folder:

* The python file that contains the program
  + ShrimpSim.py
* The images for each of the different life stages
  + Egg.png
  + Hatchling.png
  + Juvenile.png
  + Adult\_Female.png
  + Adult\_Male.png
  + Dead.png
* The parameter sweep bash file (optional, but recommended)
  + Parameters.sh

The user must also ensure that they have these modules for python installed on their computer:

* random
* pygame
* time
* sys

## 2.2 Guide

To run the program with the default numbers simply run the python from a BASH terminal by using the following command within the folder that the program is saved in.

If the user wishes to run a parameter sweep; the adjustable parameters are the initial number of shrimp in the simulation (n), the maximum velocity of the shrimp (v) and the random chance of death that occurs (r, this is measured as a probability r in 10 000). To run a parameter sweep input:

*sh Parameters.sh <minimum n> <maximum n> <change of n each run> <minimum v> <maximum v> <change of v each run> <minimum p> <maximum p> <change of p each run>*

For example if one wanted to run a sweep with a min n of 50 and max n of 70 and each run changing n by 10, a min v of 1 and a max v of 2 and a change of 1 per run, and a minimum probability of 0 and a maximum of 1, with each run changing p by 1, one would input:

*sh Parameters.sh 50 70 10 1 2 1 0 1 1*

# References

* Dann, L., & Tomkins, S.P. (2009) *Sexual selection in brine shrimps: Practical investigations using Artemia Franciscana.* Retrieved from https://bioenv.gu.se/digitalAssets/1575/1575641\_artemiaeng.pdf